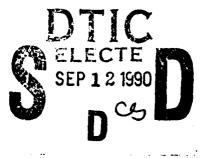U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1567

The Interdependence of Self-Reported Estimates of Individual and Unit Performance of U.S. Army Junior Officers

Hyder A. Lakhani

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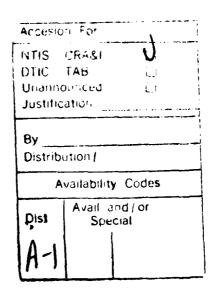
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency Under the Jurisdiction
of the Deputy Chief of Staff for Personnel

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This report integrates and extends the existing research on individual (Olsen and Borman, 1989) and group (Blades, 1986) performance by interrelating self-reported estimates of individual and group (= unit) performance in a system of simultaneous equations. The Blades (1986) model of unit performance was supported and extended by an analysis of survey data from a sample of 3,422 junior officers. These analyses showed that self-reported estimates of unit performance were related positively with: (i) the self-reported estimate of relative individual performance, (ii) command experience, and (iii) the authoritarian leadership style under which a member functioned. The Olsen-Borman (1989) model of organization and environmental variables was extended by showing that self-reported estimates of relative individual performance were related positively to: (i) the self-reported estimate of unit performance, (ii) absolute individual performance, (iii) individual confidence, and (iv) pride in service. As regards the performance of the two self-reported estimates of performance, the regression weight of the self-reported estimate of individual performance was substantially greater

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(.37) in the equation predicting the self-reported estimate of unit performance
than the regression weight (.06) of the self-reported estimate of unit perform-
ance when predicting the self-reported estimate of individual performance
equation.   In the context of this model specification, it appears that the self-
reported estimate of individual performance is more critical in explaining the
self-reported estimate of unit performance than conversely.

Research Report 1567

The Interdependence of Self-Reported Estimates
of Individual and Unit Performance
# of U.S. Army Junior Officers

Hyder A. Lakhani

The personal Utilization Technical Area of the U.S. Army
Research Institute for the Behavioral and Social Sciences (ARI)
conducts research in the areas of soldier retention, performance,
and family factors. Questions have recently arisen regarding the
Army's ability to predict individual and unit performance of
soldiers to help retain high quality soldiers.

This report quantifies predictors of self-reported estimates
of individual and unit performance of junior officers.

This research was part of a long-term research project ini-
tiated at the U.S. Military Academy and transferred to ARI in 1987
by Chief of Staff of the Army. The results of this research help
identify appropriate predictors of individual and unit-level per-
formance of junior officers for future research.

EDGAR M. JOHNSON
Technical Director

THE INTERDEPENDENCE OF SELF-REPORTED ESTIMATES OF INDIVIDUAL AND UNIT PERFORMANCE OF U.S. ARMY JUNIOR OFFICERS

EXECUTIVE SUMMARY

Requirements:

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research on manpower, personnel, training, and performance issues of significance and interest to the U.S. Army. Questions have been raised about the Army's ability to predict soldier performance and retention of high-quality soldiers.

Procedure:

The author used data from the survey of junior commissioned officers between 1980 and 1986 from the U.S. Military Academy Reserve Officers Training Corps, Officer Candidate School, and the Directly Appointed Officers. The sample of 3,422 junior officers was used to estimate a three-stage least-squares model of interdependence of self-reported measures of individual and unit performance. The predictors included command experience, type of leadership control, job satisfaction, individual confidence, pride in service, and spouse employment.

Findings:

The results suggest that the estimates of individual and unit performance were interdependent. The regression weight of the self-reported estimate of individual performance was, however, substantially greater (.37) in predicting unit performance than the regression weight (.06) of the unit performance variable in predicting individual performance. Therefore, in the context of this model specification, self-reported estimate of individual performance is more critical in explaining self-reported estimate of unit performance than conversely.

Utilization of Findings:

This research suggests that policy makers should consider influencing such predictors as command experience, leadership style, individual confidence, and pride in service for improving self-reported estimates of individual and unit performance of junior officers in the Army.

THE INTERDEPENDENCE OF SELF-REPORTED ESTIMATES OF INDIVIDUAL AND
UNIT PERFORMANCE OF U.S. ARMY JUNIOR OFFICERS

CONTENTS

LIST OF TABLES

THE INTERDEPENDENCE OF SELF-REPORTED ESTIMATES OF INDIVIDUAL AND UNIT PERFORMANCE OF U.S. ARMY JUNIOR OFFICERS

1.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

This research had two objectives: first, to specify and empirically estimate a model that integrates the existing models on individual (Olson and Borman, 1989) and group (Blades, 1986) performance; and second, to extend the existing models. The integration was attempted by interrelating self-reported measures of unit performance and perceptions of individual leadership effectiveness in a system of simultaneous equations. The extension was based on a robust statistical model and the inclusion of predictors of individual leadership and group performances that were not included in the previous research. The statistical model specified that the self-reported measures of individual leadership effectiveness were related to unit performance and to such other predictors as individual confidence, pride in service, and the source of commissioning of the junior officers. The self-reported measures of unit performance were explained by perceptions of individual leadership effectiveness, the leadership experience, and the unit's leadership control environment to which the junior officer was subjected. Such an interdependent model is specified in the section on conceptual framework discussed below.

1.1 Literature Review

1.1.1 Individual Performance

The past studies on individual performance concentrated mostly on the abilities of enlisted soldiers. The abilities were measured either in terms of their supervisory appraisals (Kahan et al., 1985) or in terms of such trainability measures as the Skill Qualification Test scores (Horne, 1986) of the soldiers required to take their occupational proficiency tests. McHenry et al. (1987) specified the individual abilities measures to specifically include leadership ability and other characteristics. These were: (i) general cognitive ability (technical and soldiering proficiency), (ii) spatial ability (effort and leadership), (iii) perceptual-psychomotor ability (dexterity), (iv) temperament/personality (Assessment of Background and Life Experience, or ABLE), based on temperament, physical condition, self-esteem, etc., (v) vocational interest, and (vi) job reward preferences. These six categories included the currently used Army accession tests and the experimental measures being tested by the U.S. Army Research Institute in Project A on selection and classification of Army enlisted soldiers prior to job entry. Olson and Borman (1989) extended the individual performance of enlisted soldiers to environmental and organizational factors that impacted on soldiers after job-

1

entry. The statistical analyses of these models were, however, restricted to factor analysis so that they did not help predict performance. It must be noted that these analyses of individual performance were not related to unit performance.

1.1.2 Unit Performance

Until recently, the existing studies on unit performance in the Army were criticized on two major grounds. First, Hall and Rizzo (1975) as well as Dyer et al. (1980) noted that a unit should be defined to be the smallest interacting collection of individuals that has a functional identity instead of being as large as a battalion or a division. Second, unit performance reports were too often based on subjective evaluations by unit leaders. For example, Kahan et al. (1985) reviewed several studies and concluded that these are "not reliable over different times, environment or raters and may be of questionable validity as well". Blades (1986) overcame the limitation about the unit size and the non-reliability generated by different raters. He compared the performance data reported by two different groups of raters of small units and concluded that the data were reliable because the reliability coefficient was .76. He then estimated bivariate correlations of unit performance with such other variables as ability, intelligence and motivation of the group leaders and the members, as well as the directive versus the nondirective style of the group leaders. He concluded that there was no direct relationship between individual and unit performance in the absence of leadership style and motivation of the members. Specifically, he argued that: "First, if one has talented and enthusiastic group members, the nondirective leadership style will produce good group performance... Second, if the members have little ability or poor motivation, nondirective leadership style will produce poor group performance... Third, the effectiveness of directive leadership style is not related to level of member ability" (Blades, 1986; p. 21-22). The statistical analysis of this model was, however, restricted to bivariate correlation so that it too did not help predict unit performance with respect to specific explanatory variables.

Fiedler and Garcia (1987) extended Blades (1986) model by including ability and experience of unit leaders and members in stress-free to stressful environments. Regarding leader ability or intelligence, they found that "the correlation between intelligence and performance of company commanders under conditions of low and high stress (+/- 1 SD) were respectively .56 (n = 7, ns) and .06 (n = 13, ns)" (p. 117). In short, under low stress conditions, intelligence correlated positively with performance, but not significantly (ns), because of the small sample size. As regards the effect of leader experience, Fiedler and Garcia (1987) noted that, they were "inclined to place more credence in the finding that jobs that demand a high level of

2

interpersonal skill may well be performed more effectively by individuals with long job tenures. These particular interpersonal skills may indeed be acquired by experience" (p. 193). The statistical analysis of this model was also restricted to bivariate correlation coefficients.

When leadership style and the leaders' abilities were not considered, however, it was observed that cognitive abilities of the members (measured by Armed Forces Qualification Test, AFQT, scores) explained unit performance significantly. For example, Block et al. (1989) reviewed performance of enlisted soldiers in four Army units and concluded that units which had soldiers with higher AFQT scores performed significantly better than units with successively lower AFQT scores of the members. These unit performance results were similar to the abovereferred results of individual performance based on SQT scores. These unit performance measures were, however, not related to individual performance and were also restricted to performance of enlisted soldiers.

1.2 Conceptual Framework

Accordingly, the purpose of this research was: (a) to estimate a model of interdependence of the self-reported estimates of individual and unit performance, (b) examine the predictors that explain these performance estimates, and (c) to focus on the self-reported estimates of performance of the junior officers instead of enlisted soldiers. This study builds on previous efforts (Blades, 1986) on unit performance and the determinants of individual performance (Olson and Borman, 1989). The study of interdependence is important to predict unit performance based on individual performance or vice versa so that in future research one need not collect data for both the performance measures. A study of junior officers is important because these officers tend to be in the leadership roles at the platoon or the company command levels.

1.2.1 Unit Performance

In order to analyze the interdependence, unit performance, an outcome variable, was hypothesized to relate positively to a construct of perceptions of individuals about their relative success in their "leadership roles", while statistically controlling for other constructs. The unit outcome variable (discussed below) was developed in this study from a question asking the officers to rate their units in terms of "mission accomplishments," an ex post construct. This unit performance construct was related to perceptions of individual officers about

the extent of their relative effectiveness in their leadership roles. The operationalization of the unit outcome and the individual effectiveness constructs was as follows:

The U.S. Army Research Institute survey (discussed below) collected data on self-reported estimates of individual and unit level performance of the officers. These estimates were constrained by reference to similar individuals and similar units, respectively, that is, individuals who had similar ranks and units which had similar missions. These measures were called self-reported estimates of relative performance. The self-reported estimate of relative unit performance was obtained by asking the officer: "How would you rate your unit in terms of mission accomplishments, relative to other units performing similar missions?". The responses were recorded on a six-point scale: (i) in the top tenth percentile, (ii) in the 11th to 20th percentile, (iii) in the 21st to 30th percentile, (iv) in the 31st to 40th percentile, (v) in the 41st to 50th percentile, and (vi) in the bottom 50th percentile. The soldiers who were not assigned to any unit were required to respond: "Does not apply". The last catagory of responses was excluded from the analysis.

The unit performance outcome construct was operationalized by using the responses to the relative unit performance question. We re-coded the responses varying from 1 to 6 for the officers in the bottom 50th percentile to the top tenth percentile respectively.

This relative unit performance outcome variable was hypothesized to relate to the following set of explanatory variables:

Self-reported estimate of relative individual performance

This explanatory variable was postulated to relate positively to the self-reported estimate of relative unit performance because the group performance can at least be equal to average performance of its members. Some authors suggest that it can be greater than the average performance. For example, the U.S. Department of Labor (1989) noted that "the strength of an organization is multiplied by the number of people contributing to it".

The definitions of perceptions of individual performance were in absolute and relative terms. The definition of the self-reported estimate of absolute individual performance was based on the question: "How effective are you in carrying out your duties in your present leadership role?". The responses varied from very effective to very ineffective, with the usual "Does not apply" category for those not in any unit. The question on self-reported estimate of relative individual performance asked: "How would you rate yourself in terms of leadership performance,

4

relative to other officers in your rank?". The responses were recorded on a six point scale, varying from "In the top 10th percentile" to "In the bottom 50th percentile", with the usual "Does not apply" category. A limitation of this database was that these self reports overstated performance estimates. This limitation was, however, overcome by using a regression equations methodology (discussed below) that adjusted for the effects by using the statistically estimated instead of the reported observed values and by statistically controlling the effects of other predictors in a system of equations.

These constructs were operationalized by re-coding the responses from 1 to 6 for the bottom 50th percentile to the top 10th percentile respectively. The relative individual performance variable was expected to relate positively to the dependent variable of relative unit performance.

Command experience

The unit performance can be enhanced if a leader is relatively more experienced. This is an observed variable instead of the perceived construct referred to above. We selected a command experience variable because this specific experience is a stepping stone to success in the Army in general and in combat units in particular. The effect of this observed variable in predicting unit performance was hypothesized to be in addition to the effect of perceived success as a leader by the individual officer.

This variable was used to extend Blades (1986) and Fiedler and Garcia's (1987) models of unit performance because the former did not have an experience variable and the latter had "such simple (emphasis supplied) experience measures as time in service, time on the job or number of different jobs" (p. 201). This specific command experience variable is superior to the simplistic time in service variable because the command position enables an officer to apply leadership training. Blades (1986 : 47) noted that "military officers earn their commissions by successfully completing programs with high intelligence requirements". In short, not all of the junior officers get command positions. The time in service variable is simplistic because it includes non-command experience which is not related to the leadership experience. The command experience of junior officers in our sample pertains to all the three ranks. For example, the Lieutenants command the platoons while Captains command the companies. A company consists of three or four platoons (Department of the Army, 1982).

This variable was defined by asking the question: "I am or I have already commanded at the company grade level (e.g. company, battery, troop, shop officer, aviation platoon, etc.): (A) 1 - 6 months, (B) 7 - 12 months, (C) More than 12 months, (D) Have not

had command, (E) Does not apply". It must be noted that this question pertained to units of relatively small size which were more meaningful for analysis of unit performance than were such large size units as a battalion, a brigade or a division. This variable was operationalized by re-coding A=1, B=2, C=3, D=0, and by excluding officers in category E because officers in this category were not likely to have been in the fields and hence cannot have any command experience.

Authoritarian control

The third construct used to predict the unit performance outcome was the extent of authoritarian control exercised over the junior officer by his/her superior officer. This is the environment in which an officer operates. A preferred variable in this construct would be the extent of stress on the junior officer in this environment but we did not have such data. Another preferred construct would have been the leadership style of the junior officer himself/herself, as in Blades (1986). The authoritarian construct in this study was, therefore, the "command and control" environment in which the junior officer operated.

This variable was an extension of Blades (1986) model because it referred to the supervisory style under which a junior officer functioned, not his/her own style of leadership, as propounded in Blades. It was hypothesized that authoritarian control of the junior officers would be related positively to the self-reported unit performance outcome variable because the traditional view of the Army is that it is a disciplinarian organization managed by "command and control" doctrine.

This predictor was defined in the survey question: "Specify - The amount of authoritarian control exercised over you by your immediate supervisor?". The responses were: A. Well above other officers, B. Above other officers, C. About the same as other officers, D. Below other officers, and E. Well below other officers. This variable was operationalized by combining A and B = 1, to represent authoritarian control; D and E = 0, to denote non-authoritarian control; and by excluding the C responses.

Command assignment

The fourth construct used to predict the outcome of unit performances was the assignment of an officer to a specific major command. The rationale for including this construct was the possibility that certain commands offer greater opportunities to enhance the outcome of unit performance relative to other commands. For example, officers assigned to U.S. Army, Europe (USAREUR), Western command and the Eighth U.S. Army in Korea are likely to have higher unit performance relative to officers

assigned to Training and Doctrine command (TRADOC) because of the imminent threat to security at the time these data were collected. The officers assigned to Forces Command (FORSCOM) are also likely to have higher to unit performance because this command is directly responsible for readiness of the forces in the Continental United States. It was, therefore, necessary to determine the effect of assignment to a specific command independent of the preceding constructs. Therefore, assignment of an officer in the TRADOC was hypothesized to be negatively related to unit performance relative to the assignment in the other commands.

This variable includes officers that were assigned to the TRADOC at the time of the survey. This variable was defined by asking the officer to indicate their command assignment in one of the five commands. The responses were operationalized by coding officers assigned to TRADOC = 1, else = 0.

Job satisfaction

Apart from the preceding four predictors, unit performance was also hypothesized to depend on an affective construct of an overall job satisfaction of a junior officer. This construct was employed because it includes several aspects of a job that are likely to be excluded from the four predictors discussed above. For example, the extent of such non-leadership aspects of a job as satisfaction with: filling forms, working hours, pay and allowances and career enhancement, are likely to be embodied in this overall job satisfaction construct. Such an overall index of job satisfaction was hypothesized to increase unit performance. This hypothesis was based on Parker and Kleemeier (1951) who noted that "... management has at long last discovered that there is greater production, and hence greater profit, when workers are satisfied with their jobs. Improve the morale of a company and you improve production" (p. 10).

This variable is generally measured by a Likert scale of an overall job satisfaction by asking respondents whether they are satisfied or dissatisfied with their jobs (Locke et al., 1964). Efforts were made by other researchers to refine the usual Likert scale of general satisfaction level. Wanous and Lawler (1972) reviewed them and concluded that, "it is not clear whether many of the newer measures are, in fact, measuring the same thing as a simple satisfaction rating". Therefore, we used the older definition of an overall job satisfaction. This explanatory variable was defined in terms of a five-point Likert scale of responses to the question: "Specify: The feeling of satisfaction in your work." The responses varied from extremely dissatisfied to extremely satisfied. These responses were also operationalized by developing a binary variable based on re-coding the last two responses as satisfied, the first two responses as dissatisfied, and by excluding the third category.

7

One of the reasons for collapsing this five-point scale (and other similar scales discussed below) into a binary variable is that the five-point scale is not equidistant from one point to another. The two-point binary scale changed the quantitative five-point scale to a qualitative dummy variable, satisfied versus dissatisfied, so that there is an absence of a potentially erroneous interpretation of an equidistant scale.

Spouse employment

Wilensky (1960) and Schwab and Cummings (1970) suggested, among others, a theory of spillover from family life to work life or productivity. This theory has been empirically supported (Lakhani 1989; Liou et al., 1990). Griffith et al. (1989: 107) showed that spouse employment increased the soldiers' satisfaction with family life, which, in turn, increased satisfaction with the military as a way of life. The spouse employment predictor represents satisfaction with family life, a construct which is independent of the preceding five constructs. Based on the literature, it was hypothesized that spouse employment will be positively related to unit performance. The spouse employment variable was defined by asking the married officers if their spouses were: "A. Not employed for pay and not looking for paid work, B. Not employed for pay but looking for paid work, C. Employed for pay part-time (less than 35 hours per week), and D. Employed for pay full-time (35 hours or more per week)". The responses were operationalized by re-coding B = 0 (unemployed), C or D = 1 (employed) and by excluding officers in category A because these are not included in the labor force participation rate of the U.S. Department of Labor.

Statistical control variables

Apart from the preceding set of six constructs, five socioeconomic and demographic variables were added to predict unit performance. These included race, sex, education and marital status. The rationale for these variables was to statistically control for the effects of these variables since these variables cannot be influenced by policy makers. The hypothesized relationships of these variables to the unit performance outcome cannot be specified a priori because of the statistical nature of these variables. The control variables were: (a) Race (White = 1, else = 0); (b) Sex (Male = 1, else = 0); (c) Education (High School Graduate = 1, else = 0); (d) Education (College Graduate = 1, else = 0); (e) Married = 1, else = 0.

The usual stochastic error term, el, was also included in this equation.

8

1.2.2 Individual Performance

The construct on perceptions of junior officers about their effectiveness in performance of their duties in their leadership roles was related mostly to a set of predictors oriented to individual rather than the unit performance. As discussed below, explanatory variables unique to this equation were required to avoid the statistical problem of identification of the two equations (Judge et al., 1982). The variables that were unique to this equation were: (i) self-reported estimate of absolute individual performance, (ii) individual confidence, (iii) individual's pride in service, and (iv) the self-reported estimate of relative unit performance. The development of these variables is discussed below.

Absolute individual performance

The definition of this variable was discussed above (Section 1.2.1). It was operationalized by combining the two responses stating "effective" and "very effective" and re-coding them = 1; else = 0. It was hypothesized that this variable would be positively related to the dependent variable on relative individual performance.

Individual confidence

Individual confidence is directly related to the abilities and skills possessed by the officers in the individual performance of their duties. The impact of these job skills and abilities can be greater than the effect of perception of leadership abilities which can be only a part of overall abilities. This construct was not used as a predictor of unit performance because individual confidence is more likely to be related to individual performance rather than unit performance. Also, the statistical methodological problem (discussed below) dictated using unique variables to identify the equation.

The rationale for including the individual confidence variable was that individual job skills and abilities are important for inducing individual confidence in getting the work done. Olson and Borman (1989: 123) had factor analyzed 15 items on job skills and characteristics. They obtained five distinct factors, one of which was labelled by them as job/task importance. For this factor, they found that the item of individual skills and abilities had the highest weight (.69) in that factor. The individual confidence variable in this study was defined in terms of the question: "Specify: The feeling of confidence in your ability to do your work". The five-point Likert scale responses to this question varied from "well above

9

other officers" to "well below other officers". These
responses were operationalized by re-coding the first two
responses = 1, the last two responses = 0 and by excluding the
response: about the same as other officers.

Pride in service

This construct was included to verify Moskos' (1977) theory
of institutional versus occupational soldiers. This theory is
more relevant for individuals rather than groups and hence this
variable was also used to predict individual performance. Also,
the statistical methodology required the use of unique variables
to identify this equation.

The institutional soldiers were defined to be the patriotic
soldiers who took considerable pride in serving the country
relative to the occupational soldiers who tended to consider Army
service as a job rather than an avocation. We hypothesized that
soldiers who took pride in their service would have higher
higher estimates of individual performance than those without
such pride. Since it is difficult to separate institutional and
occupational soldiers, this variable was defined by asking the
officers if they agreed or disagreed with the statement: "I get
a sense of pride from my career". The five-point Likert scale
responses varied from "strongly agree" to "strongly disagree".
This variable was operationalized by re-coding the responses
strongly agree and agree = 1, strongly disagree and disagree = 0,
and by excluding the responses stating neither agree nor
disagree.

Estimated value of unit performance

This construct was used as an explanatory variable of
individual performance to determine the interdependence between
unit performance and individual performance as reflected in the
leadership roles. As discussed in the method section below,
instead of the observed value of the variable, the statistically
estimated value of the variable was used for operationalization.
It was hypothesized that this variable would be positively
related with the dependent variable on individual performance
because of the theory of positive interdependence between the two
performance variables.

Statistical control variables

The fifth construct was a group of variables common to the
preceding equation on unit performance. The rationale for their
inclusion is discussed below in the method on the three stage
least squares. The variables common to the two equations were:
marital status, spouse employment, race, sex and authoritarian
control environment. Finally, a group of constructs on the source
of commissioning of the officer was included because, as

10

discussed below, the recruiting standards are different for the four different sources of commissioning so that the individual performance of the source-specific officer is also likely to be different.

Finally, a stochastic error term, _e2_, was also added to this equation.

2.0 METHOD

2.1 Survey of Junior Officers

The Army Research Institute (1987) conducted a voluntary survey of junior officers commissioned between 1980 and 1986. These officers were in the ranks 01 through 03, that is, Second Lieutenants, First Lieutenants and Captains. The sample frame of 7,000 officers included about 1,000 officers from each of the seven commissioning year-groups. This sample was drawn from personnel administrative files called the Officer Master Files. The sources of commissioning included: (a) the U.S. Military Academy (USMA) at West Point, (b) the Reserve Officers' Training Corps (ROTC), (c) the Directly Appointed officers such as doctors, attorneys and chaplains, and (d) the officers selected from Non-commissioned enlisted officers for the Officer Candidate Schools. The survey instrument was distributed to the subjects through points of contact (POC) at the selected Army installations. The officers were requested to mail the completed instruments within a specified time. The response rate of about 50 percent provided a sample of 3,422 officers. This sample included officers that commanded: (a) combat units such as infantry, armor and the artillery that constitute the front line, (b) combat support units such as engineering, scientific and military intelligence operations that provide logistical support with equipment and materiel, and (c) combat services support units comprising such technically trained soldiers as medical officers and nurses.

The survey was administered to officers assigned to five major command (MACOMs) divisions of the U.S. Army. The first of these MACOMs was the Training and Doctrine Command (TRADOC) which is responsible for basic and advanced occupational training and indoctrination of officers and enlisted soldiers. The second MACOM was the Forces Command (FORSCOM) responsible for readiness of about one million soldiers in the enlisted, officer, Reserve and National Guard ranks located in the Continental United States and Alaska. The third MACOM was the U.S. Army in Europe (USAREUR) which commands all active U.S. Army forces in Europe. The fourth MACOM, Western Command (WESCOM), was responsible for active Army troops in Hawaii. The fifth MACOM was the Eighth U.S. Army located in Korea. The Southern Command located in Panama was not included in the sample because of its small size.

2.2 Three-Stage Least Squares Equations

The interdependence or the reciprocal relationship method is that of a system of three-stage least squares (3SLS) simultaneous equations (Hausman, 1975). This methodology is similar to the two-stage least squares (2SLS) used by James and Singh (1978). The 2SLS method is superior to the Ordinary Least Squares method because it uses the statistically estimated value (instead of the observed or reported value) of a dependent variable in the first equation as an explanatory variable in the second equation. Such an explanatory variable is "purged" of its correlation with other variables so that there is no problem of multicollinearity of the explanatory variables (Smith and Ehrenberg, 1983; p.354). For example, in the first equation, the self-reported estimate of relative unit performance is a dependent variable and the self-reported estimate of relative individual performance is an explanatory variable. In the second equation, the statistically estimated (not observed) value of the dependent variable in the first equation is used as an explanatory variable. The statistically estimated variables of the self-reported performance measures are, therefore, adjusted downward relative to their observed or reported values. Schmitt and Bodeian (1982) compared the 2SLS results with LISREL and concluded that the reciprocity results of the two methods were comparable.

The 3SLS method is superior to the 2SLS method because, as Judge et al. (1982) show, it is similar to the "full information maximum likelihood estimates" instead of the 2SLS method which is comparable with the "limited information maximum likelihood estimates". The 2SLS estimators are unbiased but inefficient because they fail to use the information on covariances of the error terms. The 3SLS method uses this information so that the estimators are not only unbiased but also efficient. An advantage of the use of this information is that it adjusts for the variations across units and individuals, thereby enhancing reliability of the results if the variances are large due to design differences (Shavelson and Webb, 1981). It must be noted that the variance explained (R-squared) by each set of predictors of the two equations is the same irrespective of the composition of the two sets of predictors. In fact, the notion of explained variance or R-squared of each equation is meaningless in this system of interdependent variables and the error terms.

3.0 RESULTS AND DISCUSSION

Table 1 shows the results of the self-reported estimate of relative unit performance outcome equation. From this Table it is observed that, as expected, the perceptions of self-reported estimates of relative individual performance are positively related to the dependent variable. The standardized regression coefficient or Beta value of this coefficient at .37 is statistically significant (p < .01) so that an improvement in the

12

self-reported estimate of relative individual performance is directly related to the self-reported estimate of relative unit performance. It must be noted that the effect of the self-reported estimate of individual performance is significant even after the effects of such other explanatory variables as command experience, job satisfaction, race, sex, and educational levels are accounted for. Second, as expected, the command experience variable is positively and significantly related to the dependent variable on the self-reported estimate of relative unit performance. The Beta weight (.16) of this predictor is, however, smaller relative to that of the individual performance predictor perhaps because of a small variation in the extent of experience of these junior officers. It must be noted that this effect is important even after the effects of the other explanatory variables are excluded. Third, the Beta weight of the authoritarian control variable is the smallest (.07) of the three positive and significant predictors of the unit performance outcome variable. Fourth, the assignment of an officer to the Training Command is related negatively (Beta= .93) to the dependent variable on the self-reported estimate of relative unit performance. Most of the other explanatory variables bear the hypothesized signs. None of them is, however, statistically significant (p <.01).

Table 2 shows the results of the self-reported estimate of relative individual performance equation. The Beta coefficient for the self-reported estimate of relative unit performance variable at .06 is significant (p < .01). The positive sign of this coefficient indicates that the two performance variables are interdependent. A comparison of this Beta coefficient with that of the self-reported estimate of relative individual performance at .37 in equation 1 indicates that individual performance has greater regression weight in the unit performance equation than conversely.

The three unique variables used in this equation are also positively and significantly related to the dependent variable. The Beta coefficient for individual confidence is the highest at .75, followed by the self-reported estimate of absolute individual performance at .38 and the pride in service variable (.09). These results indicate that individual confidence, an indicator of job skills and abilities, is the most important predictor of individual performance. The positive sign of the absolute individual performance and the pride in service variable show that they add to the average positive effect of individual confidence and relative unit performance. Hence the results of these three predictors extend the Olson-Borman model of individual performance.

13

The signs of the statistical control variables reveal that married (Beta= .16) officers are more likely to have higher individual performance than are unmarried officers. This suggests the possibility of a spillover of family life and work life proposed by Wilensky (1960). The positive sign of the USMA variable indicates that officers recruited from this source are more productive relative to the combined group of officers recruited from all other sources. Similar interpretation is also applicable to the ROTC variable.

The system R-squared (adjusted for sample weight) of both of the equations is the same because they were estimated simultaneously. Therefore, as noted earlier, the total variance explained in each of the two equations is the same irrespective of the composition of the sets of predictors of the two equations. The sample weight or the number of degrees of freedom at 6,816 (the number of cases, 6,844, minus the number of variables, 28, in the system of equations) is about twice the sample size because the simultaneous estimation of the two equations results in adding the number of cases in both the equations. The value of R-squared at .36 is not too low given the fact that these are cross sectional instead of the time series data. As noted earlier, the R-squared value is not very meaningful in a system of equations because the estimated value of the dependent variable in the first equation is used as an explanatory variable in the second equation and the error terms of the two equations are not independent of each other.

4.0 SUMMARY, CONCLUSIONS, AND FUTURE RESEARCH

In sum, as conceptualized in this paper, the self-reported estimates of individual and unit performances are interdependent and related positively to each other. The Beta weight of the self-reported estimate of perceptions of individual performance is, however, substantially greater in the equation predicting unit performance than the Beta weight of the unit performance when predicting self-reported estimate of the individual performance. Therefore, it appears that, given the specification of this model, the self-reported estimate of individual performance is more critical in explaining the self-reported estimate of unit performance than conversely.

The self-reported estimate of unit performance variable is explained significantly by the command experience of the officer so that we have succeeded in extending Blades' (1986) and Fiedler and García's (1987) models by predicting unit performance outcome with command experience of the junior officers. Also, officers who were subject to an authoritarian leadership have higher unit performance, when statistically controlling for command experience. The Blades (1986) model of unit performance was integrated with the Olson and Borman (1989)

14

TABLE 1

Regression Results for Self-Reported Estimates of Unit
Performance Equation

Explanatory variable	Beta Coeff.	t Ratio
Intercept	2.04	2.06
Perceptions of Relative Individual Performance	0.37	14.53*
Command Experience	0.16	3.17*
Authoritarian Control	0.07	2.41*
Training Command	-0.93	12.02*
Job Satisfaction	-0.08	-2.25
Spouse Employment	-0.002	0.09
Race (White)	-0.03	0.39
Sex (Male)	-0.06	0.56
High School Graduate	0.42	1.53
College Graduate	-0.09	1.11
Married	-0.11	1.50

System R-squared (weight-adjusted) = 0.357, F-Ratio = 83.91*

Degrees of Freedom = 6,816

* Significantly different from 0 , $\underline{p}$ < .01

15

TABLE 2

Regression Results for Self-Reported Estimates of Relative
Individual Performance Equation

Explanatory variable	Beta Coeff.	t Ratio
Intercept	-0.82	1.76
Relative Unit Performance	0.06	5.00*
Absolute Individual Performance	0.38	20.01*
Individual Confidence	0.75	12.99*
Pride in Service	0.09	3.77*
Married	0.16	3.45*
U.S. Military Academy	1.15	2.86*
ROTC	1.08	2.68*
Direct Commission	0.54	1.24
O.C.S. Commission	1.00	2.47
Spouse Employed	-0.02	1.08
Race (White)	0.004	0.07
Sex (Male)	0.11	1.66
Authoritarian Control	0.007	0.42

System R-squared (weight-adjusted) = 0.357, F-Ratio = 83.91*

Degrees of Freedom = 6,816

* Significantly different from 0, $\underline{p}$ < .01.

model of individual performance to the extent that Blades model refers to outcome of unit performance and the Olson and Borman (1989) model includes perceptions of leadership performance of the individuals.

The self-reported estimate of individual performance is explained significantly by such individual-specific variables as individual confidence, individual's pride in service, and the self-reported estimate of absolute individual performance. These variables were not available to Olson and Borman (1989) so that we have succeeded in extending their model of individual performance while statistically controlling for other variables that could not be controlled in their model.

In view of the preceding findings, future research should attempt to interrelate and integrate individual and unit performance measures. In so doing, however, it should probe for such additional explanatory variables as command experience, command assignment, individual confidence, and an individual's sense of pride in service, so as to increase the extent of variance explained by these variables as well as to obtain unbiased predictors. The future research should also attempt to develop more objective measures of individual and unit performance for officers and validate the currently available subjective measures. One of these objective measures is included in the current research at the U.S. Army Research Institute (ARI) on the impact of family and non-family variables on unit performance/readiness. As a part of this research, data collection has just been completed with an instrument called the "1989 Army Soldier and Family Survey". These data are likely to be available in mid-1990. They can be match-merged, by social security numbers, to the extent possible, with the ARI's Project A data on individual performance of enlisted soldiers reported in Olson-Borman (1989). Analysis of such a match-merged file can help researchers not only integrate individual and unit performance but also relate performance to morale and readiness.

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